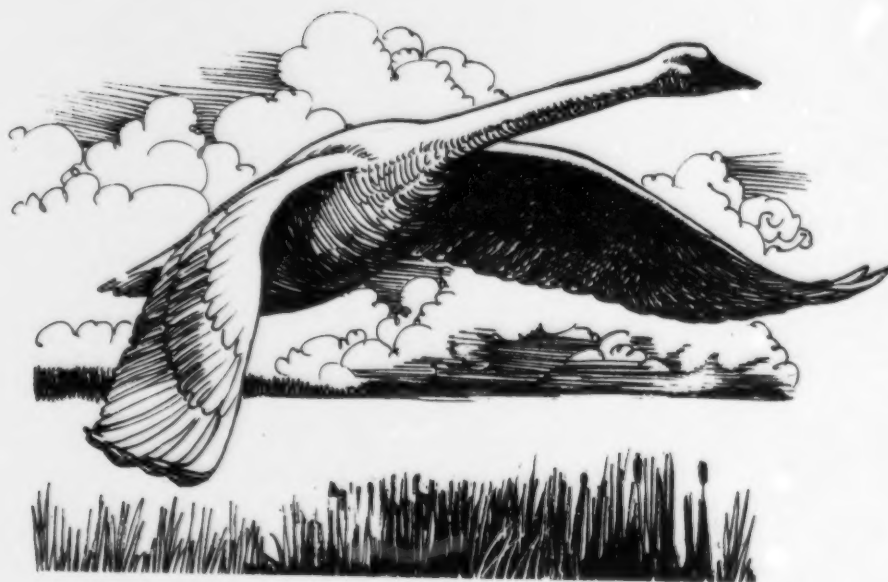


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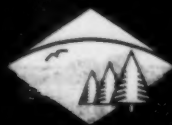
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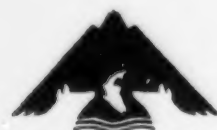
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Alberta Wildlife Status Report No. 26



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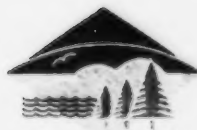
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M. Lynne James

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For copies of this report, contact:

Information Centre - Publications

Alberta Environment

Natural Resources Service

Main Floor, Great West Life Building

9920 - 108 Street

Edmonton, Alberta, Canada T5K 2M4

Telephone: (780) 422-2079

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Alberta Environment

#100, 3115 - 12 Street NE

Calgary, Alberta, Canada T2E 7J2

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PREFACE

Every five years, the Fisheries and Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991 and 1996, assign individual species to 'colour' lists that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A primary objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the 1996 *Status of Alberta Wildlife* review process, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (Red or Blue listed), that are of uncertain status (Status Undetermined), or which are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fisheries and Wildlife Management Division of Alberta Environment, and are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta Wildlife Act. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

Trumpeter Swans once ranged in a wide band from Alaska to southern Quebec, and from Oregon to Mississippi. However, by the early 1900s, a combination of habitat destruction and hunting nearly extirpated this species from Canada and the lower 48 states. In the second half of this century, Trumpeter Swan populations have increased and the species is no longer considered to be at risk by the Committee on the Status of Endangered Wildlife in Canada. In Alberta, the Trumpeter Swan is currently listed as a 'threatened animal' under the provincial Wildlife Act.

The majority of Trumpeter Swans in Alberta breed near the city of Grande Prairie. However, scattered flocks occur throughout Alberta, with small numbers in the Cardston-Pincher Creek area, Elk Island National Park, Edson-Whitecourt, St. Paul-Lac La Biche and Peace River areas. Although annual aerial Trumpeter Swan surveys have been conducted in Alberta every fall since 1957, variations in survey effort makes it difficult to establish a clear population trend. However, the general consensus is that numbers are increasing despite limiting factors such as shortage of winter habitat, human disturbance in breeding habitat, accidental hunting and collisions with power lines.

Trumpeter Swans have benefited from management in Alberta, which has included population surveys, land use guidelines and reintroductions. However, increasing numbers of swans mean pressure on already overcrowded wintering areas will also increase. Therefore efforts to expand the wintering range of Alberta swans while managing breeding areas must continue to ensure the perpetuity of the Trumpeter Swan in Alberta.

ACKNOWLEDGEMENTS

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INTRODUCTION

The Trumpeter Swan (*Cygnus buccinator*) was once common throughout North America. By the 1900s, however, a combination of habitat destruction and hunting led the species to near extinction (Subcommittee on the Interior Population of Trumpeter Swans 1997). In 1978, Trumpeter Swans were listed as a 'vulnerable*' species in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Mackay 1978). Fortunately, efforts to recover Trumpeter Swans have been undertaken throughout many parts of its former range and almost all swan populations have increased in the latter half of this century (McKelvey et al. 1985, Beyersbergen and Shandruk 1993, Subcommittee on the Interior Population of Trumpeter Swans 1997). Trumpeter Swans are no longer listed as a species at risk by COSEWIC (1999) but are still considered a 'threatened animal' under the Alberta Wildlife Act.

Many studies of Trumpeter Swan population size and trends, distribution and biology have been carried out in Alberta and elsewhere. This report summarizes current and historical information on the Trumpeter Swan, as a step in reviewing the status of the species in the province.

HABITAT

Summer habitat for the Trumpeter Swan varies widely throughout its range. In Alberta, trumpeters live in scattered flocks on lakes and marshes in the Aspen Parkland and Boreal Ecoregions (Strong and Leggat 1992). Mitchell

(1994) lists the basic breeding habitat requirements for the Trumpeter Swan as being adequate room to take off (approximately 100 m), accessible forage, shallow, stable levels of unpolluted fresh water, emergent vegetation, a muskrat (*Ondatra zibethicus*) house, island or other structure for the nest site, and low human disturbance. Similarly, Trumpeter Swan nesting lakes in Alberta generally have at least five common characteristics: lake water levels do not have marked seasonal fluctuations; the waters are quiet, without strong wave action or currents; shallow water so the swans can dig for tubers and roots of aquatic plants; isolation and security from human disturbance; and areas of emergent vegetation (Banko 1960, Nordstrom 1984). Nests are rarely located in upland areas but are usually located near shore, on small islands, or on muskrat and beaver (*Castor canadensis*) lodges (Hansen et al. 1971, Brechtel 1982, G. Beyersbergen, pers. comm.). Habitats supplying high abundance of aquatic invertebrates (Lockman et al. 1987) and/or aquatic plants (Squires 1991) have the greatest swan production.

Most of Alberta's Trumpeter Swans winter in the United States in the 'tristate' area where the borders of Montana, Idaho and Wyoming meet (Shea 1979). Weather is the greatest single factor affecting winter distribution and survival in this area as temperatures can reach -45°C, and snow accumulations average 250-380 cm (McEneaney 1984). Trumpeter Swans survive in these harsh conditions because a combination of complex geological formations and weather patterns in the area create mild microclimates. Almost annually, a midwinter thaw occurs that lasts from one to two weeks and opens up water that may otherwise freeze (McEneaney 1984).

The tristate region also has unique geothermal

* See Appendix 1 for definitions of selected status designations

and hydrological features. There is a large system of thermal basins, natural springs, ponds, lakes, and rivers that offer open water for wintering habitat (McEneaney 1984). Trumpeter Swans are not found directly adjacent to hot springs and geysers because few plants survive there, but are often found downstream, where the warm water mixes with cooler water (McEneaney 1984). Natural springs such as Big Springs in Idaho, and Culver Springs in Montana also provide ideal winter habitat because these areas are shallow, slow moving, and free of ice.

CONSERVATION BIOLOGY

The Trumpeter Swan is North America's largest native waterfowl, with females weighing an average of 9.9 kg and males weighing an average of 10.3 kg (Palmer 1976, Drewien and Bouffard 1994). These swans are completely white except for their black bills and legs, and are easily mistaken for the slightly smaller Tundra Swan (*Cygnus columbianus*). Some subtle morphological differences exist between the species (for example, most Tundra Swans possess a yellow spot in front of the eye), but the only consistent difference between Trumpeter and Tundra Swans is their voice; Trumpeter Swans have a deep trumpet-like call, whereas Tundra Swans have a high-pitched "bark" (Munro 1962, Palmer 1976, Drewien and Bouffard 1994).

Canadian Trumpeter Swans wintering in the tristate area leave for their breeding grounds between 1 March and 1 April (Mitchell 1994). The initial pair bonds are formed from late March to mid-May (Lockman et al. 1987). Trumpeter Swans pair with life-long mates as early as their second winter, and most swans are paired by the end of their third winter (Palmer 1976, Brechtel 1982). Despite this

early pairing, the average age of first reproduction by Trumpeter Swans in Alberta is five years (Brechtel 1982).

Trumpeter Swans arrive in Alberta in mid-April to early May (Pinel et al. 1991). Nest building occurs between late April and early May and breeding density is generally one pair per lake or pond (Brechtel 1982, Mitchell 1994). Nests are used for many years, and take several days to two weeks to build (Palmer 1976, Brechtel 1982, Grant 1991). A typical Trumpeter Swan nest is approximately 1.8-3.6 m in diameter and 0.5 m high and may be comprised of cattails (*Typha latifolia*), bulrushes (*Scirpus* spp.) and horsetails (*Equisetum* spp.) lined with down (Brechtel 1982, Grant 1991). The nest is often built on a beaver lodge, muskrat house, small island, or on a floating mat of vegetation, and the adults may remove vegetation from around the nest to provide good visibility and protection from predators (Brechtel 1982, Mitchell 1994).

Clutches of 3-9 eggs are laid (Brechtel 1982) and there is a suggestion that the clutch size is determined by the nutritional condition of the female (Mitchell 1994). Incubation lasts 32-37 days and the female undertakes most of the incubation duties (Mitchell 1994). When the incubating female takes a break to feed, the eggs are covered carefully with grass and down, presumably to provide insulation and to make the eggs less visible to predators (Grant 1991, Henson and Grant 1991, Mitchell 1994). While the female is incubating, the male feeds and defends the territory (Cooper 1979, Brechtel 1982, Grant 1991, Henson and Grant 1991). The female will help the male defend the territory, but extended absences from the nest may lower incubation success, as eggs may either overheat or become cool (Cooper 1979, Henson and Grant 1991).

Hatching success for Trumpeter Swans ranges from 50-90% (Burgess 1972). In the Grande Prairie area, hatching success averages 77.2% with an average brood size of 2.93 cygnets (Beyersbergen and Shandruk 1993). Reasons eggs might not hatch include infertility, embryonic death and, to a limited extent, egg depredation (Brechtel 1982). Trumpeter Swans will not attempt to renest in the same year if first clutches are lost (Mitchell 1994).

Grant (1991) found that once cygnets hatch, the adults are rarely more than 20 m apart and cygnets are usually 5-10 m from one or both parents. Cygnets feed almost exclusively on aquatic invertebrates and crustaceans for the first 2-5 weeks after hatching (Banko 1960, Hansen et al. 1971, Page 1976). By the age of 2-3 months, however, a cygnet's diet is the same as an adult's, and consists of stems, roots and shoots of horsetail, pondweed (*Potamogeton* spp.), sedges (*Carex* spp.), and other plant material (Holton 1982, Grant 1991). Both adults and cygnets spend most of their time feeding in emergent vegetation, and adults may eat up to 9 kg of food per day (Holton 1982). This massive food requirement is one reason the density of swans is limited to one swan family per lake (Brechtel 1982).

Growth of cygnets is rapid, and by 13-15 weeks, most cygnets have had their first flight (Shea 1979, Brechtel 1982). In mid-September, Trumpeter Swans stage on larger lakes before migrating to wintering areas. In Alberta, most swans begin to migrate south by mid-October (Semenchuk 1992), however some swans remain as late as mid-November (Brechtel 1982).

Mortality for Trumpeter Swans is highest during the first year of life. Survival of cygnets during the pre-flight period has been reported

at 45-78% (Banko 1960, Brechtel 1982, Lockman et al. 1987, Bart et al. 1991). In the Grande Prairie area, survival from fledging to one year was reported at 42.9%, with most of the mortality occurring during late winter and the spring migration (Turner and Mackay 1981). However, survival from 1-2 years was 70.9%, and from 2 - 3 years was 82.4% (Turner and Mackay 1981). Elsewhere, annual survival for birds over two years of age has been reported as 80-100% (Anderson et al. 1986, Lockman et al. 1987, Lockman 1990, Bart et al. 1991).

Sources of mortality include predation, disease and parasites, weather, lead poisoning, accidental shooting and electrocution on power lines (Mitchell 1994). Predation is not considered to be a major source of mortality (Brechtel 1982), but birds of all ages (including eggs) may be taken by a variety of avian and mammalian predators (Mitchell 1994). Diseases and parasites are potential sources of mortality, but not significant on their own. Drewien and Bouffard (1994) found that nasal leeches in trumpeters wintering in the tristate area can be a direct cause of death in cygnets and can weaken adults. Thus, a high parasite load in the winter may make certain individuals more susceptible to severe winter weather.

DISTRIBUTION

1. Alberta. - Trumpeter Swans historically bred throughout Alberta. By the early 1900s, however, the entire Canadian population was thought to have been extirpated (see below) until 1918 when a small flock was discovered in the Grande Prairie area (Mackay 1981). Currently in the province, Trumpeter Swans occur in scattered flocks on lakes and marshes in Aspen Parkland and Boreal Mixed-wood forests (Figure 1). Most of Alberta's Trumpeter

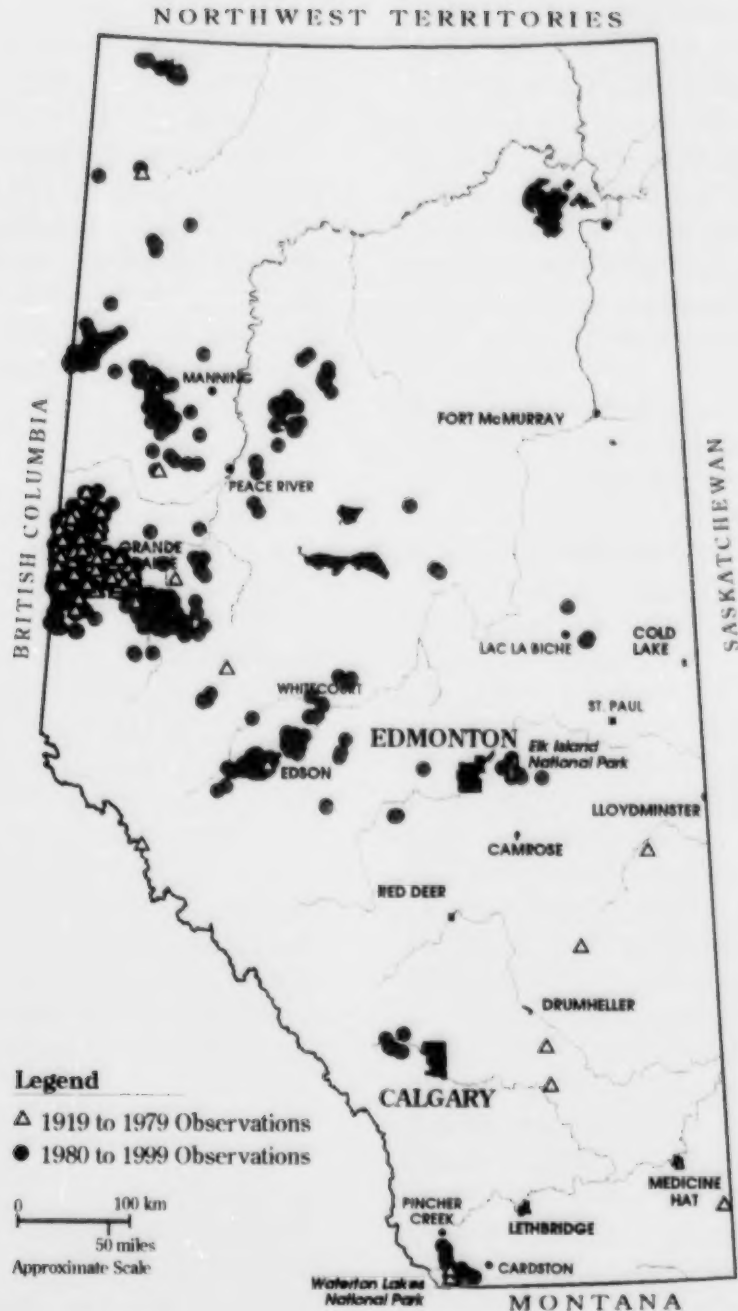


Figure 1. Records of Trumpeter Swan observations in Alberta 1919-1999. Details of individual records are kept in the Biodiversity/Species Observation Database maintained by the Alberta Conservation Association and Alberta Environment.

Swans breed in the Peace River District, in an area that extends 80 km west and north, and 50 km southeast and southwest of the city of Grande Prairie (Brechtel 1982, Shandruk 1984, G. Beyersbergen, pers. comm.). The distribution in the Grande Prairie area is gradually increasing; swans occurred on only 16 lakes from 1957 to 1967, but 63 in 1977, 82 in 1987 and 67 in 1997 (Canadian Wildlife Service, unpubl. data).

Flocks of Trumpeter Swans have also been located in other areas of the province. In the Peace River and Manning areas, pioneering flocks have been located in the Otter and Russell Lakes area 100 km northeast of Peace River, and along the Chinchaga River northwest of Manning (McKelvey et al. 1985). Other trumpeters have been found near Edson, where they were first recorded in 1978 on Tie Camp Lake (Nordstrom 1984). Observations of Trumpeter Swans in the Whitecourt area are possibly an expansion of the flock from the Edson area. Recently, observations of Trumpeter Swans have also increased in the Lac La Biche-St. Paul area. This increase in sightings may be the result of colonization by Trumpeter Swans reintroduced at Elk Island National Park (see 'Population Size and Trends' section, below; G. Beyersbergen, pers. comm.). A small breeding population also occurs in the Cardston-Pincher Creek area near Waterton Lakes National Park.

Most Alberta swans winter in the tristate area on a 14 km stretch of the Snake River near Harriman State Park in Idaho (Reiswig 1984). Birds released in Elk Island National Park have been observed in central Oregon at Summer Lake and Harney Lake National Wildlife Refuges and the Sacramento Valley in northern California (Beyersbergen and Kaye 1995).

2. Other Areas. - Historically, Trumpeter Swans bred across North America between Alaska and the Atlantic Coast, and as far south as Mississippi (Hansen 1973, Palmer 1976, Rogers and Hammer 1978, Mitchell 1994, Subcommittee on the Interior Population of Trumpeter Swans 1997; Figure 2). Rogers and Hammer (1978) suggested that the species once wintered in at least a portion of all of the contiguous 48 states. By the early 1900s, the destruction of breeding and wintering habitat and market and subsistence hunting, extirpated the Trumpeter Swan from most of North America leaving the species at the brink of extinction (Palmer 1976, Subcommittee on the Interior Population of Trumpeter Swans 1997). At that time, it is estimated that all that remained of the Trumpeter Swan occurred in the tristate area of northwest Wyoming, eastern Idaho, and southwest Montana (Banko 1960) and in the Grande Prairie region of Alberta (see above). The Pacific Coast population, which breeds in Alaska, was not discovered until the early 1950s (Brechtel 1982).

Today, because of reintroduction programs and intensive management, Trumpeter Swan numbers are increasing (see 'Population Size and Trends' section, below), and populations are divided into three distinct groups. The Pacific Coast population breeds in Alaska and winters along the Pacific Coast in southwestern Alaska, western and south-central British Columbia, western Washington and western Oregon (Hansen et al. 1971, Conant et al. 1984, Mitchell 1994, Subcommittee on the Interior Population of Trumpeter Swans 1997). The Rocky Mountain population is divided into two subpopulations. The non-migratory tristate subpopulation and the Canadian subpopulation, which breeds in scattered flocks in Alberta, northeastern British Columbia, southeastern Yukon, southwestern Northwest

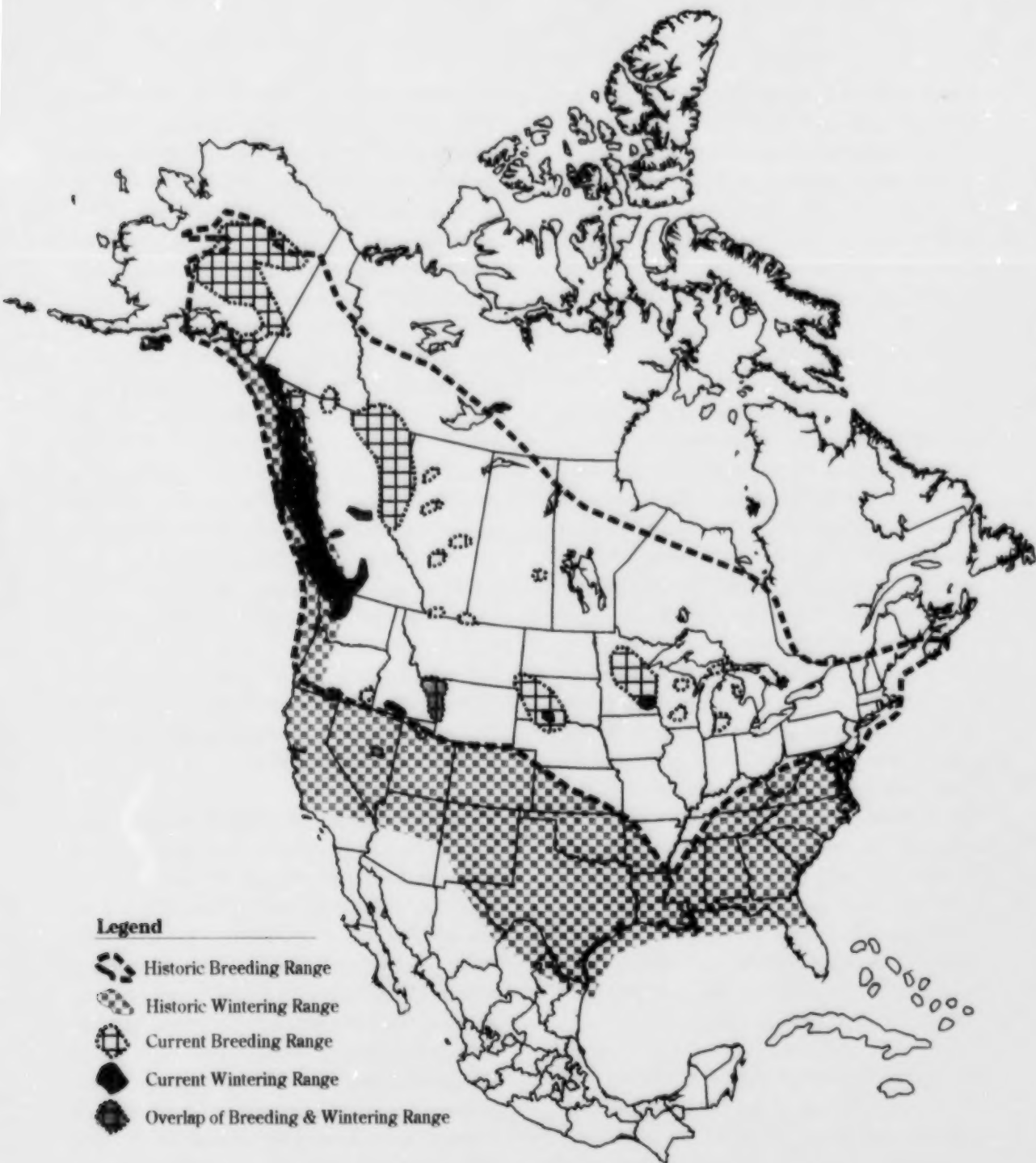


Figure 2. Distribution of the Trumpeter Swan in North America (adapted from Mitchell 1994 and Subcommittee on the Interior Population of Trumpeter Swans 1997).

Territories, and extreme southwestern Saskatchewan (Nieman 1972, Nieman and Isbister 1974, McCormick 1984, McKelvey 1984, Reiswig 1984, Beyersbergen and Shandruk 1993, Subcommittee on the Interior Population of Trumpeter Swans 1997). The majority of birds from the Rocky Mountain population winter in the tristate area (Reiswig 1984). The Interior population includes birds breeding in eastern Saskatchewan, Ontario, extreme eastern Wyoming and Montana, South Dakota, Nebraska, Wisconsin, Michigan, Minnesota and Iowa (Mitchell 1994, Subcommittee on the Interior Population of Trumpeter Swans 1997). These birds winter primarily in Illinois, Iowa, South Dakota, Nebraska and Kansas (Mitchell 1994, Subcommittee on the Interior Population of Trumpeter Swans 1997).

POPULATION SIZE AND TRENDS

1. Alberta. - Alberta's Trumpeter Swan population accounts for roughly 30% of the Canadian population (Caithamer 1996), and has been gradually increasing since 1944. Most of this growth has been in the Grande Prairie and Peace River regions where approximately 67% of Alberta's Trumpeter Swans breed. Some pioneering flocks have begun to establish in other areas of the province (see 'Distribution' section, above).

In 1944, 64 adults and 14 cygnets were observed in the Grande Prairie area but the first aerial fall survey was conducted in 1954 and a more accurate count of 232 swans resulted (Mackay 1981). Annual fall aerial surveys were initiated in 1957 by the Canadian Wildlife Service and continued until 1995 (G. Beyersbergen, pers. comm.). Results from these surveys show that the Trumpeter Swan population in the Grande Prairie area appeared

to remain fairly stable until the early 1970s, with a gradual increase from the early 1970s to 1981, and an even greater increase from 1981 to 1998 (Canadian Wildlife Service, unpubl. data). However, annual inconsistencies in the coverage and effort of aerial surveys makes population trends difficult to establish, and it is possible that the increased survey effort in later years reflects an effort to document an expanding Trumpeter Swan population. Analysis of the data shows that the number of lakes surveyed accounts for 48% of the variation in the data but that the year of survey accounts for another 12% of the variation (L. James, unpubl. data). Therefore, Trumpeter Swans are increasing in the Grande Prairie region, regardless of the number of lakes surveyed (Figure 3). The decrease in numbers during the 1987-1998 period, appeared to be caused by annual movement of swans between lakes and the movement of non-breeding swans to lakes outside of the survey area (G. Beyersbergen, pers. comm.).

The smaller flocks near Edson-Whitecourt, Cardston-Pincher Creek, Elk Island National Park, St. Paul-Lac La Biche, and Manning have remained small, but Trumpeter Swans have been consistently using these areas since 1983 (Canadian Wildlife Service, unpubl. data). From 1962 to 1998, the Cardston-Pincher Creek area near Waterton Lakes National Park had adult swans in 19 out of 36 years, with an average of 5.5 adults in the years adults were present (Canadian Wildlife Service, unpubl. data). Since Trumpeter Swans were first recorded there in 1978, the population in the Edson area has slowly increased, reaching a peak of 19 adults and 18 cygnets in 1993, then falling back to nine adults and five cygnets in 1998. A small number of Trumpeter Swans have been reintroduced to Elk Island National Park where the swans had been extirpated since

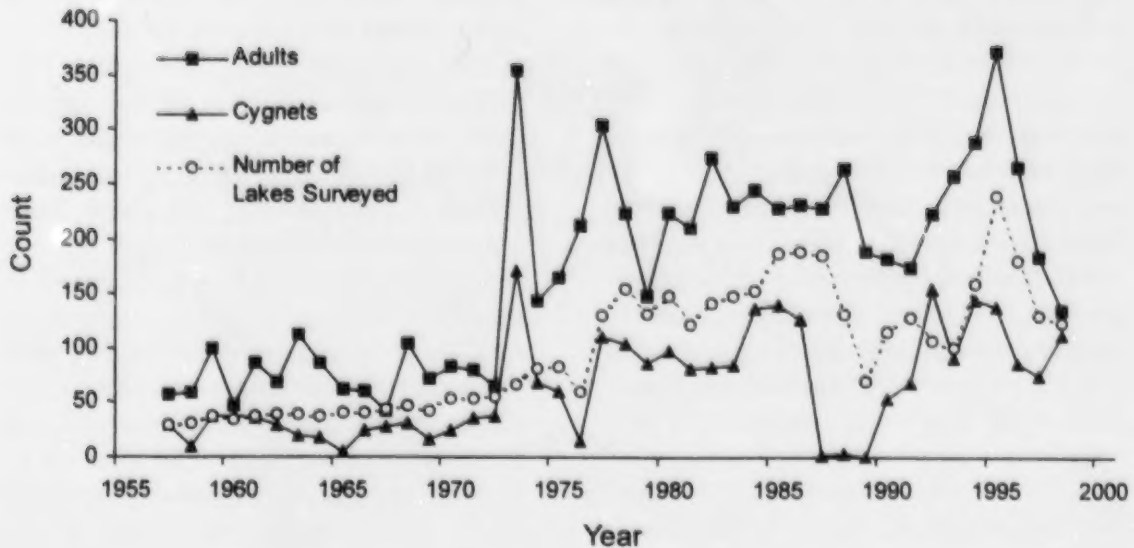


Figure 3. Trend in the population of Trumpeter Swans observed during fall aerial surveys in the Grande Prairie area of Alberta 1957-1998.

the late 1880s (Shandruk 1984, Beyersbergen and Kaye 1995). In 1998, three pairs of swans were recorded in the park and one of those pairs successfully fledged four cygnets: the first such occurrence in the park this century (G. Beyersbergen, R. Kaye, pers. comm.). In 1999, the same pair hatched seven cygnets, three of which survived to fledge (R. Kaye, pers. comm.).

Overall, the population of Trumpeter Swans in Alberta has made a remarkable recovery since the turn of the century. Estimates at that time were that less than 100 individuals remained in the province (Mackay 1978). A census conducted in 1995 showed that 779 swans occurred in Alberta in that year (G. Beyersbergen, pers. comm.).

2. Other Areas. - In the early part of the twentieth century, it was believed that all that remained of the world's Trumpeter Swans was 69 birds in the tristate area of northwestern

Wyoming, eastern Idaho, and southwestern Montana (Banko 1960) plus a small population in Alberta. International Trumpeter Swan surveys were first conducted in 1968, then again in 1975 and every five years after that time, yielding good estimates of population trends (Figure 4).

The Pacific Coast breeding population was the first population to be thoroughly surveyed. In 1959, 1124 birds were counted (Conant et al. 1984). Subsequent surveys showed a dramatic rise in Trumpeter Swan numbers with estimates reaching 3641 in 1968 (U.S. Fish and Wildlife Service 1970), 7696 in 1980 (King and Conant 1981, Conant et al. 1984), and 16 312 in 1995 (Subcommittee on the Interior Population of Trumpeter Swans 1997).

The Rocky Mountain population increased from 811 individuals in 1968 to more than 2600 in 1996 (Caithamer 1996). Over the same period, the Canadian subpopulation, which

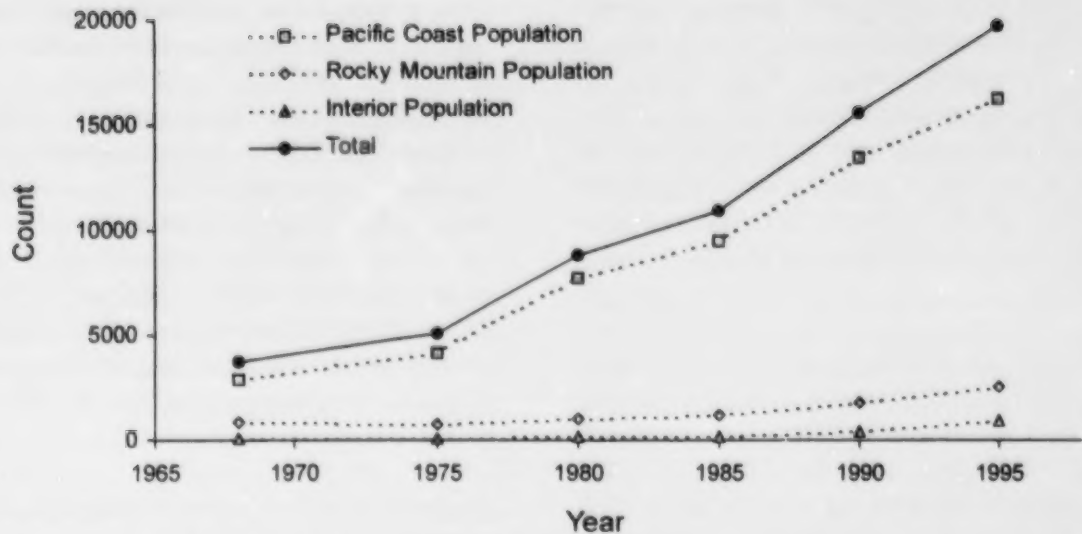


Figure 4. Trend in the North American population of Trumpeter Swans, 1968-1995 (adapted from Caithamer 1996).

includes breeding swans in Alberta, south-eastern Yukon, Northwest Territories and northeastern British Columbia, also increased, but the number of birds in the non-migratory tristate subpopulation decreased (Lockman et al. 1984, Reiswig 1984, Drewien and Bouffard 1994). Therefore, any increase in the Rocky Mountain population is occurring within Canada.

The increases in the Canadian subpopulation of the Rocky Mountain population are the result of expansions of established flocks in Alberta (see above) and the establishment of new breeding flocks. For example, a small breeding population in the area west of the Liard Range in the Northwest Territories was discovered in 1976. It is believed that this population is newly established, as extensive surveys in this area reported no Trumpeter Swans prior to 1976 (McKelvey et al. 1983, 1985). Eighteen adults were found in this area in 1984 (McKelvey et al. 1985) and in 1995,

the population had increased to 161 adults (Caithamer 1996). In the Yukon, the swan population in the Toobally Lakes region decreased slightly from 68 adults in 1981, to 45 adults in 1985 (McKelvey et al. 1985). It is possible that the large forest fire that swept the area in 1982 either killed or displaced the birds in that area (McKelvey et al. 1985). Sightings of Trumpeter Swans in the Peace River and northern regions of British Columbia are also recent, and seem to be on the increase.

The Interior population of Trumpeter Swans, although small, has increased dramatically over the past three decades. This population has been re-established through reintroduction programs and winter feeding programs that have taken swan numbers from less than 50 individuals in 1965 (Subcommittee on the Interior Population of Trumpeter Swans 1997) to 927 in 1995 (Caithamer 1996). The Interior population has grown so much that small pioneering flocks have established in eastern

Saskatchewan and western Ontario (Caithamer 1996, Subcommittee on the Interior Population of Trumpeter Swans 1997). Once this intensively managed population exceeds 2000 birds, reintroductions and winter feeding programs may be ceased and the population will be allowed to sustain itself (Subcommittee on the Interior Population of Trumpeter Swans 1997).

Overall, the outlook for the Trumpeter Swan in North America is much more positive today than it was almost a century ago. From less than 2000 birds worldwide in 1959, the population has grown to over 19 000 in 1995 (Caithamer 1996, Subcommittee on the Interior Population of Trumpeter Swans 1997). However, while Trumpeter Swan numbers are increasing, much of that increase has been in the Pacific Coast population, which breeds in Alaska. The 1995 international survey estimated the Canadian population at 2681 individuals, which amounts to only 13% of the world's Trumpeter Swans (Caithamer 1996, Subcommittee on the Interior Population of Trumpeter Swans 1997, G. Beyersbergen, pers. comm.).

LIMITING FACTORS

1. *Shortage of Winter Habitat.* - A critical shortage of winter habitat is widely considered to be the primary limiting factor for the Rocky Mountain population, which includes birds breeding in Alberta (Shea 1979, Mackay 1981, Brechtel 1982). This population of Trumpeter Swans faces a unique challenge, because over 90% of the birds winter in a very limited region of the tristate area (Barrett and Vyse 1982, Reiswig 1984, Alvo 1996). As a result, because of migration tradition, birds that breed successfully in Canada and the United States, return to the same crowded wintering area,

limiting their ability to discover other more favourable wintering areas (Barrett and Vyse 1982, Shea 1997, G. Beyersbergen, pers. comm.). The concentration of such a large portion of the population also means that any significant loss of habitat could cause a large decrease in the population (Alvo 1996). The overcrowded conditions have been the cause of large winter die-offs; in 1984 and 1989 severe winter conditions caused the Snake River to freeze resulting in the death of at least 50 and 100 swans, respectively (McKelvey et al. 1985).

Competition for food in overcrowded wintering areas (Shea 1979) causes at least three possible problems. First, because they have not fed properly, migratory females start the breeding season in poor condition. Second, females from the tristate subpopulation may make the short flight from their wintering areas to their breeding areas too early, when the breeding areas are still frozen, giving them little chance to improve their nutrient reserves (Page 1976). Finally, overcrowding and competition for food increases the prevalence of parasitic nasal leeches in food-deprived birds (Drewien and Bouffard 1994) which can further weaken adult birds and make them more susceptible to severe winter weather, or can kill cygnets outright.

Trumpeter Swan relocation and hazing (i.e., harassing swans to encourage them to go elsewhere) programs in the tristate area are showing some degree of success in dispersing Trumpeter Swans to other wintering areas (Alvo 1994). However, as more cygnets are produced each year on the breeding grounds, the pressure on the wintering areas will only increase.

2. *Shortage of Breeding Habitat.* - It is not clear whether lack of breeding habitat is a

limiting factor for Trumpeter Swans. Shandruk (1984) states that breeding habitat, primarily in the Aspen Parkland region, has been lost through drainage and water manipulation projects that accompany agriculture, industrial development, and urbanization. However, availability of breeding habitat or the ability of swans to colonize new areas is not believed to be a limiting factor by some (Alvo 1994). In the Grande Prairie area, lakes that have successfully produced cygnets in the past, are not used every year, suggesting that swans are not limited by the number of suitable lakes (Holton 1982, Canadian Wildlife Service, unpubl. data). Disturbance of breeding habitat (see below), rather than lack of breeding habitat, may in fact be limiting Trumpeter Swans during the breeding season.

3. Disturbance in Breeding Habitat. - Few studies have investigated the effects of disturbance on Trumpeter Swan breeding and behaviour. Trumpeter Swans can become accustomed to air traffic and small amounts of automobile traffic, even when the disturbance is relatively close to nesting areas (Holton 1982, Henson and Grant 1991). However, Trumpeter Swans are very sensitive to extremely loud traffic (planes flying within 60 m, large gravel trucks, motorbikes), boating, floatplane use, pedestrian traffic, and human intrusion on a breeding lake (Holton 1982, Henson and Grant 1991). These disturbances may cause nest failures or cygnet loss by disrupting feeding behaviour or causing females to take extended absences from the nest (Henson and Grant 1991). Because Trumpeter Swans will not renest, clutch failure results in the loss of the breeding production for an entire year (Grant 1991, Henson and Grant 1991). Furthermore, in the case of severe disturbances, a pair may permanently abandon a breeding lake (Brechtel 1982).

Shandruk (1984) suggests that habitat degradation and disturbance are major problems in the Grande Prairie area. As land use intensifies, previously productive lakes become unsuitable for Trumpeter Swans. Three previously productive lakes (Saskatoon Lake, Wembley Lake, and Crystal Lake) in this area are no longer used for breeding, probably because of both recreational use and adjacent intensive land use (Brechtel 1982). The disturbance of Trumpeter Swans on lakes in Alberta can be controlled effectively through land use permits, if those lakes are surrounded by Crown land. Unfortunately, in 1982, only 23% of the 72 lakes used by Trumpeter Swans for breeding in Alberta were surrounded solely by Crown land (Brechtel 1982). As well, once access to lakes is created, secondary human access and recreational activity can have a profound impact on swan breeding (Shandruk 1984).

4. Hunting. - Biologists generally agree that the dramatic reduction in Trumpeter Swan numbers that occurred in the 18th and 19th centuries was the result of overexploitation through commercial hunting (Banko 1960, Monnie 1966, Brechtel 1982, Subcommittee on the Interior Population of Trumpeter Swans 1997). Hunting of Trumpeter Swans has been illegal since the inception of the Migratory Bird Treaty Act in 1918. However, because of the similarity between Tundra and Trumpeter Swans, hunters may mistakenly shoot Trumpeter Swans where legal seasons exist for Tundra Swans (Mackay 1981, Shandruk 1984, Drewien and Bouffard 1994). In 1992, wildlife departments in Montana, Nevada and Utah (where there are legal seasons to hunt Tundra Swans), requested that hunters report bill length of harvested swans to detect Trumpeter Swans that were shot accidentally (Drewien and Bouffard 1994). From these reports, they

found that 11 of 295 reported harvested swans were likely Trumpeter Swans.

5. Collisions with Power Lines. - Electrocutation resulting from collisions with power lines is thought to be a significant source of mortality for Trumpeter Swans. Several studies report high mortality from power lines and wire fences (Lockman et al. 1987, Gillette 1990, Lockman 1990). In the Grande Prairie area, 6-10 swan electrocutions are reported annually, but the actual number of deaths from electrocution is likely much higher (D. Hervieux, pers. comm.).

STATUS DESIGNATIONS

1. Alberta. - The Trumpeter Swan is currently designated as a 'threatened animal' under the Alberta Wildlife Act. In 1991, the Trumpeter Swan was assigned to Alberta's 'Red List' of species at risk in the province because of low population size and critical shortage of wintering habitat (Alberta Fish and Wildlife 1991). Because of the increase in the breeding population, the species was reassigned to the 'Blue List' in 1996 (Alberta Wildlife Management Division 1996). The Alberta Natural Heritage Information Centre lists the Trumpeter Swan as S3B in the province (ANHIC 1999; see Appendix 1 for explanation of ranks).

2. Other Areas. - In 1978, the Committee on the Status of Endangered Wildlife in Canada listed the Trumpeter Swan as a 'vulnerable' species because concerns still existed over low population levels and restricted distribution (Mackay 1978). By 1996, additional information about the expanding distribution and population of Trumpeter Swans resulted in their being redesignated to the 'not at risk' category (Alvo 1996). In the United States, the Trumpeter Swan was removed from

consideration for listing under the Endangered Species Act following the 1954 discovery of the Pacific Coast population in Alaska (Erickson et al. 1969, King and Conant 1981).

According to The Nature Conservancy's Natural Heritage Program criteria (see The Nature Conservancy 1999 and associated links), the Trumpeter Swan is globally listed as G4. Subnational ranks in Canada include S3S4B, S4N in British Columbia and S1B in Saskatchewan. The species is extirpated in Manitoba (SXN) and has been the subject of reintroduction programs in Ontario (SHC). At the core of its range in the United States, the Trumpeter Swan is ranked as S3N in Washington, S2B in Nevada, S1B, S2N in Idaho, S2B, S2N in Montana, S1B, S2N in Wyoming and S2 in Nebraska. In other states where it still occurs, the Trumpeter Swan is either not listed, or is listed as an accidental species.

RECENT MANAGEMENT IN ALBERTA

1. Elk Island National Park Trumpeter Swan Reintroduction. - In 1987, following the identification by Alberta Fish and Wildlife that human disturbance and habitat loss was a threat to the long-term survival of the Trumpeter Swan in the Grande Prairie area, an Alberta-based Trumpeter Swan reintroduction program was initiated by Parks Canada, Canadian Wildlife Service, Friends of Elk Island National Park and Alberta Fish and Wildlife. Elk Island National Park was selected for the program because of the available habitat, the protection afforded by a federally-protected area and because of the proximity of the park to a major population centre (R. Kaye, pers. comm.). The purpose of the project was to re-establish a breeding population of Trumpeter Swans in Elk Island National Park and to establish an Alberta

population that wintered on the Pacific Coast where winter habitat is not limiting (Shandruk and Holton 1984). Family groups from the Grande Prairie area were relocated to Elk Island National Park. The adult birds returned to the Grande Prairie area in subsequent years but some cygnets have returned to the park and surrounding areas as subadults. In 1998, a pair of swans hatched and fledged four cygnets - the first such occurrence in the park in over one hundred years (R. Kaye and G. Beyersbergen, pers. comm.). Swans released in Elk Island National Park have been observed in new wintering areas in central Oregon and northern California, and although the tristate area is still extensively used, it appears that the project has been successful in encouraging the expansion to new wintering areas.

2. Land Use Regulations. - In the Grande Prairie area, provincial biologists make recommendations to Public Lands or Lands and Forest Service (LFS) to apply land use conditions to new dispositions near swan lakes. Specifically, some of the land use regulations include: 1) permit holders should not work within 800 m of Trumpeter Swan lakes, and may not fly over these lakes during the breeding season (1 April-30 September); 2) there should be no long term development (such as roads, wells or pipelines) within 500 m of Trumpeter Swan lakes, including drilling of geophysical shot holes; 3) there should be no new grazing leases issued around swan lakes; and 4) there should be no timber harvesting within 200 m of swan lakes (A. James, pers. comm.).

These conditions are not legislated and do not apply to private land owners (although biologists encourage private landowners to use the conditions too). Many swan lakes that occur on Crown land also have protective notations (PNTs) attached to them that mean that Public Lands and LFS must adhere to the

recommendations of provincial biologists regarding those lakes.

3. Public Education. - In 1992, Alberta Environment published several thousand copies of a brochure on Trumpeter Swans as part of the '*Alberta's Threatened Wildlife*' series (see Alberta Fish and Wildlife 1999). This document outlines status, description, habits, biology, limiting factors, management and outlook for the species. This brochure has been widely distributed among landowners and others. A teachers' guide to accompany the brochure was also developed for use in classroom programs. An update of the brochure is planned in 2000.

SYNTHESIS

The Trumpeter Swan has made a remarkable recovery since the turn of the century when it was close to extinction. In Alberta, management efforts have resulted in increasing numbers of Trumpeter Swans from approximately 232 individuals in 1954 to 779 in 1995. Most of the increase has been in the Grande Prairie area but flocks have also increased and new flocks have been initiated in other parts of the province.

Despite population increases, the Trumpeter Swan still requires management to ensure its survival in Alberta. Availability of breeding habitat does not appear to be an important limiting factor in the province, and disturbance and degradation of breeding lakes is being controlled through land use regulations. The critical shortage of wintering habitat continues to be a serious problem and a catastrophic event in the tristate area threatens to severely impact the population of Trumpeter Swans breeding in Alberta. To a limited extent, efforts to expand wintering destinations for Alberta birds

have been successful and should continue. Standardized province-wide surveys should also continue because they provide accurate population information and allow for habitat conditions to be assessed and, if necessary,

appropriate management action to be implemented. The next international Trumpeter Swan survey is planned for the fall of 2000.

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APPENDIX 1. Definitions of selected legal and protective designations.

A. Status of Alberta Wildlife colour lists (after Alberta Wildlife Management Division 1996)

Red	Current knowledge suggests that these species are at risk. These species have declined, or are in immediate danger of declining, to nonviable population size
Blue	Current knowledge suggests that these species may be at risk. These species have undergone non-cyclical declines in population or habitat, or reductions in provincial distribution
Yellow	Species that are not currently at risk, but may require special management to address concerns related to naturally low populations, limited provincial distributions, or demographic/life history features that make them vulnerable to human-related changes in the environment
Green	Species not considered to be at risk. Populations are stable and key habitats are generally secure
Undetermined	Species not known to be at risk, but insufficient information is available to determine status

B. Alberta Wildlife Act

Species designated as 'endangered' under the Alberta Wildlife Act include those defined as 'endangered' or 'threatened' by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 1999)

Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limiting factors are not reversed
Vulnerable	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events
Not at Risk	A species that has been evaluated and found not to be at risk
Indeterminate	A species for which there is insufficient scientific information to support status designation

D. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

E. Natural Heritage Element Rarity Ranks (after The Nature Conservancy 1999)

Global or G-rank: Based on the range-wide status of a species.

Sub-national or S-rank: Based on the status of a species in an individual state or province. S-ranks may differ between states or provinces based on the relative abundance of a species in each state or province.

G1 / S1	Critically imperiled because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction
G2 / S2	Imperiled because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range
G3 / S3	Either very rare or local throughout its range, or found locally in a restricted range (21 to 100 occurrences)
G4 / S4	Apparently secure, though it might be quite rare in parts of its range, especially at the periphery
G5 / S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery

B - A rank modifier indicating breeding status for a migratory species.

N - A rank modifier indicating non-breeding status for a migratory species.

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